Extreme Field Science and Exploration of Vacuum(Topological Aspects of Solid State Physics)

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DAY 1: 14:50 – 15:30

VBS States in SU(N) Heisenberg Model

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We study ground states of SU(N) generalization of the Heisenberg model on the square lattice. The representation used for the B sub-lattice is conjugate to that for the A sub-lattice. In the case of the fundamental representation (on A), we find that the ground state is the VBS state for sufficiently large N. We also find U(1) symmetric structure in the ground state space, which may correspond to the emergent U(1) symmetry in the vicinity of the deconfinement criticality. Due to this (approximate) symmetry, it is technically very difficult to determine the dimer pattern in the VBS states that will be realized in the thermodynamic limit. For higher representation, the VBS order is weak even if it is present. We only confirm that the Neel order disappears at some critical value of N close to the predicted value by Read and Sachdev. In the case of SU(3) and SU(4), with the fundamental representation, we also investigate spatially anisotropic case. We observe a direct phase transition from the VBS phase to the spin nematic phase. Our numerical results suggest the transition is of the second order.

DAY 1: 16:00 – 16:20

Extreme Field Science and Exploration of Vacuum

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When electric field approaches the Schwinger field, vacuum begins to warp and finally erupts, i.e. pair creation of electron and positron. (This is akin to the breakdown of semiconductor by stron enough laser to produce an exciton.) We call such science as Extreme Field Scinece. In this we study QED in its fully nonlinear regime and possibly explore the property (物性) of vacuum. It is expected that many types of new nonlinearities may emerge close to the extreme field regime near Schwinger. We would like to exchange ideas on this and recently vigorou condensed matter science adavnce in topological order and other property and mathematics.